REVISED DRAFT

SAMPLING AND ANALYSIS PLAN
PART II – QUALITY ASSURANCE PROJECT PLAN
POST REMOVAL SAMPLING

Bonneville Dam Project
Cascade Locks, Oregon

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LIST OF ABBREVIATIONS

ºC	Degrees Celsius
CLP	Contract Laboratory Program
DQO	Data Quality Objective
ECD	Electron Capture Detector
FSP	Field Sampling Plan
GC	Gas Chromatography
ICP	Inductively Coupled Plasma
ID	Identification
kg	Kilograms
LCS	Laboratory Control Sample
LIMS	Laboratory Information Management System
MDL	Method Detection Limit
mg/kg	Milligrams per kilogram
MS/MSD	Matrix Spike/Matrix Spike Duplicate
NWTPH-Gx	Northwest Total Petroleum Hydrocarbon – Gasoline Range Organics
NWTBP-Dx	Northwest Total Petroleum Hydrocarbon – Diesel Range Organics
PARCC	Precision, Accuracy, Representativeness, Comparability, and Completeness
PCB	Polychlorinated Biphenyl
QA	Quality Assurance
QAPP	Quality Assurance Project Plan
QC	Quality Control
RPD	Relative Percent Difference
RL	Reporting Limit
SAP	Sampling and Analysis Plan
SI	Site Investigation
SOW	Scope of Work
TOC	Total Organic Carbon
µg/kg	Microgram per kilogram
URS	URS Corporation
USACE	United States Army Corps of Engineers
USEPA	United States Environmental Protection Agency

1.0 PROJECT DESCRIPTION

This Quality Assurance Project Plan (QAPP) describes the policy, organization, functional activities, and quality assurance and quality control (QA/QC) for anticipated sediment and water sampling and analysis for the Post Removal Sampling (Post Removal Sampling) at the Bonneville Dam Project near Cascade Locks, Oregon.

The Sampling and Analysis Plan (which is composed of this QAPP and the Field Sampling Plan (FSP)), are the work plans that URS Corporation (URS) has prepared to fulfill the requirements of the United States Army Corps of Engineers (USACE) Delivery Order No. 0004 Modification No. 0006. These plans will govern the work conducted at this site.

A description of the location, historical use, and existing site data is presented in Section 1.0 of the FSP.

2.0 PROJECT ORGANIZATION AND RESPONSIBILITIES

The URS organizational structure for this project is presented in Section 2-1 of the Field Sampling Plan.

The Project Manager has overall responsibility for project activities and monitoring the project progress. The Project Manager is responsible for planning, scheduling, cost control, and completion of project tasks. The Project Manager also has overall responsibility for the development and implementation of this Management Plan, for monitoring the quality of the technical and managerial aspects of the project, interfacing with the USACE, and ensuring the timeliness of all project deliverables.

The Field Manager is responsible for coordinating and overseeing the field operations, including compliance with the SAP, change orders, scheduling, liaison with USACE, and sample record keeping.

The Analytical Chemistry Task Manager will be responsible for ensuring QA procedures are being performed in the field. The Analytical Chemistry Task Manager will also be in direct contact with the analytical laboratory to monitor laboratory activities to ensure that holding times and other QA/QC requirements are met. will oversee the analytical laboratories and will direct the validation of chemical data. The Analytical Chemistry Task Manager will work closely with the URS Project Manager, the URS Field Manager, and the analytical laboratory.

A subcontracted laboratory will provide analytical services for this project. USACE validation letters for the contract laboratory will be provided in Appendix A following URS' selection of the contract laboratories. The laboratories' QA Scientists will be responsible for performing project-specific audits and for overseeing the quality control data generated. Also, the laboratories will be in daily communication with the Analytical Chemistry Task Manager.

3.0 DATA QUALITY OBJECTIVES

3.1 BACKGROUND

Data quality objectives (DQOs) are statements which specify the quality of data required to support objectives of the investigation. The quantity and type of data to be collected during this sampling were developed on the basis of USACE's Request for Proposal (RFP) No. DACW57-99-D-005, Task Order No. 0004 Modification No. 0006.

The following DQOs have been developed for the Post Removal Sampling:

- Characterize the lateral and vertical extent of sediment contamination.
- Characterize transport and bioavailibility of contaminants for human health and ecological risk assessment.
- Determine the nature of contaminants that may pose a human health or ecological risk.
- Determine background or ambient concentrations of contaminants in reference samples not impacted by site-specific contamination.
- Produce defensible high quality data.

In order to achieve the project DQOs, two levels of data will be generated during the investigation: field screening data and definitive data.

Field screening level data will be obtained in the field with a water quality meter. Turbidity, pH, dissolved oxygen, conductivity, reduction-oxidation potential, and temperature will be measured. Field measurement methodology is discussed in the FSP.

Definitive data will be obtained by collecting samples in an approved USACE manner and sending for offsite laboratory analysis. Table 3-1 provides a summary of definitive data to be collected during the Post Removal Sampling. All definitive data will be generated using rigorous analytical methods, including approved United States Environmental Protection Agency (USEPA) reference methods, as further discussed in Section 6.0. QA objectives for chemical data measurement are further discussed in the following section.

3.2 QA OBJECTIVES FOR CHEMICAL DATA MEASUREMENT

In order to ensure high quality and defensible data, standards will be set and measured for the following data quality indicators: precision, accuracy, representativeness, comparability, completeness, and sensitivity. These QA objectives apply to all definitive data produced by offsite chemical analysis. Calculation of data quality indicators is presented in Section 9.0.

3.2.1 Precision

Precision refers to the distribution of a set of reported values about the mean, or the closeness of agreement between individual test results obtained under prescribed conditions. Precision reflects the random error and may be affected by systematic error. Precision also characterizes the natural variation of the matrix and how the contamination exists or varies within that matrix (USACE, 2001). Precision is evaluated using analyses of an analytical sample and its corresponding matrix duplicate and/or laboratory matrix spike/matrix spike duplicate, which not only exhibit sampling precision, but indicate analytical precision through the reproducibility of the analytical results. Relative Percent Difference (RPD) is used to evaluate precision. RPD criteria must meet the method requirements summarized in Table 3-1.

3.2.2 Accuracy

Accuracy is the measure of the closeness of an observed value to the "true" value (e.g., theoretical or reference value, or population mean). Accuracy includes a combination of random error and systematic error (bias) components that result from sampling and analytical operations (USACE, 2001). Sources of potential error are the sampling process, field contamination, preservation, handling, sample matrix, sample preparation, and analysis techniques. Sampling accuracy may be assessed by evaluating the results of rinse blanks. These data help to assess the potential concentration contribution from various outside sources. The laboratory objective for accuracy is to equal or exceed the accuracy demonstrated for the applied analytical methods on samples of the same matrix. The percent recovery criterion is used to estimate accuracy based on recovery in the matrix spike and matrix spike duplicate samples. The spike and spike duplicate, which will give an indication of matrix effects that may be affecting target compounds, are also a good gauge of method efficiency. Acceptable ranges of recovery are summarized in Table 3-1.

3.2.3 Representativeness

Representativeness expresses the degree to which the sample data accurately and precisely represent the characteristics of a population of samples, parameter variations at a sampling point, or environmental conditions. Representativeness is a qualitative parameter which is most concerned with the proper design of the sampling program or subsampling of a given sample (USACE, 2001). Objectives for representativeness are defined for sampling and analysis tasks and are a function of the investigative objectives. The sampling procedures, as described in the FSP, have been selected with the goal of obtaining representative samples for the media of concern. Representativeness can be assessed qualitatively by the use of field and laboratory duplicate samples.

3.2.4 Comparability

Comparability is a qualitative parameter expressing the confidence with which one data set can be compared with another (USACE, 2001). A DQO for this program is to produce data with the greatest possible degree of comparability. This goal is achieved using standard techniques to collect and analyze representative samples and reporting analytical results in appropriate units. Complete field documentation using standardized data collection forms will support the assessment of comparability. Comparability is limited by the other parameters, because only when precision and accuracy are known can data sets be compared with confidence. In order that data sets may be comparable, it is imperative that contract-required methods and procedures be explicitly followed.

3.2.5 Completeness

Completeness is defined as the percentage of measurements that are judged to be usable (i.e., which meet project-specific requirements) compared to the total number of measurements planned (USACE, 2001). It is important that appropriate QA procedures be maintained to verify that valid data are obtained in order to meet project needs. For the data generated, the goals required for completeness (or usability) of the analytical data are presented on Table 3-1. If these goals are not met, then USACE and URS project personnel will determine whether the deviations might cause the data to be rejected.

3.2.6 Sensitivity

The term sensitivity is used to describe detection/quantitation/reporting limits established to meet project-specific DQOs (USACE, 2001). The reporting limits that are required for each analysis are those listed in Table 6-2 and are consistent with applicable method requirements. The reporting limit is the lowest concentration that can be reliably achieved within specified limits of precision and accuracy during routine laboratory operating conditions. The reporting limit is generally 5 to 10 times the method detection limit (USEPA, 1997). Instrument detection limits, method detection limits, and reporting limits published within USEPA methods are based on a reagent water matrix, and ignore sample matrix interferences and the resulting effect on limits, therefore the published limits may not be achievable for environmental samples.

4.0 SAMPLING LOCATIONS AND PROCEDURES

Sampling locations and procedures are discussed in Section 4.0 of the FSP.

5.0 SAMPLE CUSTODY AND HOLDING TIMES

Procedures addressing field and laboratory sample chain-of-custody and holding times are presented in the FSP. Table 5-1 and Table 5-2 contains analytical methods and container, preservation, and holding time requirements for sediment and water matrices, respectively.

6.0 ANALYTICAL PROCEDURES

6.1 LABORATORY PROCEDURES

The laboratory procedures to be performed include methodologies from the United States Environmental Protection Agency (USEPA), Washington State Department of Ecology Analytical Methods for Petroleum Hydrocarbons, American Society for Testing and Materials (ASTM) Annual Book of ASTM Standards, and the Puget Sound Water Quality Authority (PSWQA, 1996) as presented in Table 6-1. All samples will be analyzed following the USACE Shell guidance present in Appendix I of EM 200-1-3 (USACE, 2001). Briefly described below are the sample preparation and analytical methods to be performed.

6.1.1 Semivolatile Organic Compounds (SVOCs)

6.1.1.1 Sample Preparation

Sediment sample preparation required prior to analysis for SVOCs will be performed in accordance with USEPA Method 3550B, as referenced in Table 6-1. Sample cleanup may be performed by Gel Permeation Chromatography (GPC) by USEPA Method 3640A if necessary. Additional cleanups (i.e., USEPA Method 3650B acid-base partition cleanup, or USEPA Method 3660B sulfur cleanup) may be applied if necessary.

6.1.1.2 Analytical Method

The extract will be analyzed for SVOCs by GC/MS in accordance with USEPA Method 8270C (Table 6-1). The reporting limits (RLs) for SVOCs are presented in Table 6-2. The RLs are on a wet-weight basis. Sample RLs are highly matrix-dependent. RLs are provided as guidance and may not always be achievable.

6.1.2 Polychlorinated Biphenyls (PCBs) - Aroclors

6.1.2.1 Sample Preparation

Sediment sample preparation required prior to analysis for PCBs will be performed in accordance with USEPA Method 3550B, as referenced in Table 6-1. Sample cleanup will be performed by sulfur by USEPA Method 3660B. Additional cleanups (i.e., USEPA Method 3620B florisil cleanup, USEPA Method 3630C silica gel cleanup, or USEPA Method 3665A sulfuric acid/permanganate cleanup) may be applied if necessary.

6.1.2.2 Analytical Method

The extract will be analyzed for PCBs (Aroclors) by gas chromatography (GC) utilizing an electron capture detector (ECD) in accordance with USEPA Method 8082 (Table 6-1). The RLs

for PCB Aroclors are presented in Table 6-2. The RLs are on a wet-weight basis. Sample RLs are highly matrix-dependent. RLs are provided as guidance and may not always be achievable.

6.1.3 Organochlorine Pesticides (Pesticides)

6.1.3.1 Sample Preparation

Sediment sample preparation required prior to analysis for pesticides will be performed in accordance with USEPA Method 3550B, as referenced in Table 6-1. Sample cleanup will be performed by florisil by USEPA Method 3620B. Additional cleanups (i.e., USEPA Method 3640B GPC cleanup) may be applied if necessary.

6.1.3.2 Analytical Method

The extract will be analyzed for pesticides by GC/ECD in accordance with USEPA Method SW8081A (Table 6-1). The RLs for pesticides are presented in Table 6-2. The RLs are on a wet-weight basis. Sample RLs are highly matrix-dependent. RLs are provided as guidance and may not always be achievable.

6.1.4 Diesel and Heavy Oil Range Organics

6.1.4.1 Sample Preparation

Sediment sample preparation prior to analysis for diesel and heavy oil range organics will be performed in accordance with USEPA Method 3550B, as referenced in Table 6-1. Sample cleanup by USEPA Method 3620B florisil cleanup or USEPA Method 3630C silica gel cleanup may be applied if necessary.

6.1.4.2 Analytical Method

Diesel and heavy oil range organics analysis will be performed following Washington State Department of Ecology Method Northwest Total Petroleum Hydrocarbon – Diesel Range Organics (NWTPH-Dx) for solid matrices (WDOE, 1997). The RL for diesel range hydrocarbons is presented in Table 6-2. The RLs are on a wet-weight basis. Sample RLs are highly matrix-dependent. RLs are provided as guidance and may not always be achievable.

6.1.5 Butyltins

6.1.5.1 Sample Preparation

Sediment samples for butyltins are prepared by methylene chloride/tropolone extraction and be silica/alumina cleanup.

6.1.5.2 Analytical Method

Sample digestates will be analyzed by GC/MS as described in the Krone, 1988 method reference in Table 6-1.

6.1.6 Total Metals (except mercury)

6.1.6.1 Sample Preparation

Sediment sample preparation for total metals involves acid digestion prior to analysis. This will be performed in accordance with USEPA Method 3050B (Acid Digestion of Sediments, Sludges and Soils), as referenced in Table 6-1.

6.1.6.2 Analytical Method

Total metal digestates will be analyzed following USEPA Method 6020, as presented in Table 6-1. The RLs for total metals are presented in Table 6-2. The RLs are on a wet-weight basis. Sample RLs are highly matrix-dependent. RLs are provided as guidance and may not always be achievable.

6.1.7 Mercury

6.1.7.1 Sample Preparation

Sediment sample preparation for mercury involves digestion prior to analysis, as described in USEPA Method 7471A.

6.1.7.2 Analytical Method

Mercury will be analyzed following USEPA Method 7471A for solid matrices. The RL for mercury is presented in Table 6-2. The reporting limit is on a wet-weight basis. Sample RLs are highly matrix-dependent. RLs are provided as guidance and may not always be achievable.

6.1.8 Total Organic Carbon (TOC)

6.1.8.1 Sample Preparation

Sediment sample preparation will be performed in accordance with Method 9060, as referenced in Table 6-1.

6.1.8.2 Analytical Method

Total organic carbon (TOC) will be analyzed following USEPA Method 9060. The RL for TOC is presented in Table 6-2. The reporting limit is on a wet-weight basis. Sample RLs are highly matrix-dependent. RLs are provided as guidance and may not always be achievable.

6.1.9 Grain Size

6.1.9.1 Sample Preparation

Sediment samples do not require preparation prior to analysis, as referenced in Table 6-1, but may require cleanup for anticoagulation.

6.1.9.2 Analytical Method

Grain size will be determined following ASTM Method D422.

6.1.10 pH

Sediment pH will be measured in accordance with Method SW9045C, as referenced in Table 6-1. Water samples will be measured for pH in accordance with Method 150.1, as referenced in Table 6-1.

6.1.11 Moisture Content

Moisture content will be determined following ASTM Method D2216-90.

6.1.12 Acid Volatile Sulfides (AVS) and Simultaneously Extracted Metals (SEM)

6.1.12.1 Sample Preparation

The sediment sample is prepared for AVS and SEM with hydrochloric acid as specified in the EPA Draft Method as referenced in Table 6-1. The acidified sediment sample is membrane filtered before SEM determination.

6.1.12.2 Analytical Method

Hydrogen sulfide will be determined by the colorimetric method as described in the EPA Draft Method referenced in Table 6-1. SEM will be analyzed by EPA Methods 6020 and 7471 (see Section 6.1.6 and 6.1.7).

6.1.13 Total Suspended Solids (TSS)

Water samples will be measured for TSS in accordance with Method 160.2, as referenced in Table 6-1.

6.1.14 Dissolved Organic Carbon (DOC)

Water samples will filtered in the field and measured for DOC in accordance with Method 415.1, as referenced in Table 6-1.

6.1.15 Hardness

Water samples will be measured for hardness as calcium carbonate in accordance with Method 130.2, as referenced in Table 6-1.

7.0 CALIBRATION PROCEDURES AND FREQUENCY

In order to obtain a high level of precision and accuracy during sample processing procedures, laboratory instruments must be calibrated properly. Several analytical support areas must be considered so the integrity of standards and reagents is upheld prior to instrument calibration. The following sections describe the analytical support areas and laboratory instrument calibration procedures.

7.1 ANALYTICAL SUPPORT AREAS

Prior to generating quality data, several analytical support areas must be considered:

Standard/Reagent Preparation - Primary reference standards and secondary standard solutions shall be obtained from National Institute of Standards and Technology (NIST), or other reliable commercial sources to verify the highest purity possible. The preparation and maintenance of standards and reagents will be accomplished per the methods referenced in Table 6-1. All standards and standard solutions are to be formally documented (i.e., in a bound logbook) and should identify the supplier, lot number, purity/concentration, receipt/preparation date, preparer's name, method of preparation, expiration date, and any other pertinent information. All standard solutions shall be validated prior to use. Care shall be exercised in the proper storage and handling of standard solutions (e.g., separating volatile standards from nonvolatile standards). The laboratory shall continually monitor the quality of the standards and reagents through well documented procedures.

Balances - The analytical balances shall be calibrated and maintained in accordance with manufacturer specifications. Calibration is conducted with two Class "A" weights that bracket the expected balance use range. The laboratory shall check the accuracy of the balances daily and they must be properly documented in permanently bound logbooks.

Refrigerators/Freezers - The temperature of the refrigerators and freezers within the laboratory shall be monitored and recorded daily. This will verify that the quality of the standards and reagents is not compromised and the integrity of the analytical samples is upheld. Appropriate acceptance ranges (2ºC to 6ºC for refrigerators) shall be clearly posted on each unit in service.

Water Supply System - The laboratory must maintain a sufficient water supply for all project needs. The grade of the water must be of the highest quality (analyte-free) in order to eliminate false-positives from the analytical results. Ultraviolet cartridges or carbon absorption treatments are recommended for organic analyses and ion-exchange treatment is recommended for inorganic tests. Appropriate documentation of the quality of the water supply system(s) will be performed on a regular basis.

7.2 LABORATORY INSTRUMENTS

Calibration of instruments is required to verify that the analytical system is operating properly and at the sensitivity necessary to meet established quantitation limits. Each instrument for organic and inorganic analyses shall be calibrated with standards appropriate to the type of instrument and linear range established within the analytical method(s). Calibration of laboratory instruments will be performed according to methods specified in Table 6-1.

Calibration of an instrument must be performed prior to the analysis of any samples and then at periodic intervals (i.e., continuing calibration) during the sample analysis to verify that the instrument is still calibrated. If the contract laboratory cannot meet the method required calibration requirements, corrective action shall be taken as discussed in Section 10.0. All corrective action procedures taken by the contract laboratory are to be documented, summarized within the case narrative, and submitted with the analytical results.

7.3 FIELD INSTRUMENTS

Calibration and general maintenance of field instruments will be the responsibility of the Field Investigation Task Manager. All calibration procedures and measurements will be made in accordance with manufacturers' specifications. Field instruments will be checked and calibrated prior to their use on site, and batteries will be charged and checked daily, where applicable. Instrument calibrations will be performed at the beginning of each workday and checked and recalibrated if necessary throughout the course of the day. A calibration check will be conducted at the end of each sampling day.

Equipment that fails calibration and/or becomes otherwise inoperable during the field investigation will be removed from service and segregated to prevent inadvertent use. Such equipment will be tagged to indicate that it should not be used until repaired.

8.0 INTERNAL QUALITY CONTROL CHECKS

Internal QC checks are used to determine if analytical operations at the laboratory are in control, as well as determining the effect sample matrix may have on data being generated. Two types of internal checks are performed and are described as batch QC and matrix-specific QC procedures. The type and frequency of specific QC samples performed by the contract laboratory will be according to the specified analytical method and project specific requirements. Acceptable criteria and/or target ranges for these QC samples are presented in Table 6-1.

QC results which vary from acceptable ranges shall result in the implementation of appropriate corrective measures, potential application of data qualifiers, and/or an assessment of the impact these corrective measures have on the established data quality objectives. Quality control samples including any project-specific QC which will be analyzed, are discussed below.

8.1 BATCH QC

Method Blanks - A method blank is defined as laboratory-distilled or deionized water that is carried through the entire analytical procedure. The method blank is used to determine the level of laboratory background contamination. Method blanks are analyzed at a frequency of one per analytical batch.

Laboratory Control Samples - A laboratory control sample is an aliquot of standard control matrices spiked (fortified) with all the elements being analyzed for calculation of precision and accuracy to verify that the analysis that is being performed is in control. A laboratory control sample will be performed for each matrix and parameter for which it is applicable.

8.2 MATRIX-SPECIFIC QC

Matrix Spike Samples - An aliquot of a matrix is spiked with known concentrations of specific compounds/analytes as stipulated by the methodology. The matrix spike (MS) and matrix spike duplicate (MSD) are subjected to the entire analytical procedure in order to assess both accuracy and precision of the method for the matrix by measuring the percent recovery and relative percent difference of the two spiked samples. The samples are used to assess matrix interference effects on the method, as well as to evaluate instrument performance. MS/MSDs are analyzed at a frequency of one each per twenty samples per matrix. MS and/or MSDs will be performed for all parameters listed in Table 6-1 with the exception of the grain size analysis.

Blind Field Duplicates - The field duplicate (blind or unknown to laboratory) is two representative aliquots of the same sample which are prepared and analyzed identically. Collection of duplicate samples provides for the evaluation of precision both in the field and at the laboratory by comparing the analytical results of two samples taken from the same location. Every effort will be made to obtain replicate samples; however, due to interferences, lack of homogeneity, and the nature of the solid samples, the analytical results are not always reproducible. Duplicate samples are to be included at a maximum of ten percent per matrix.

8.3 ADDITIONAL QC

Rinsate (Equipment) Blanks - A rinsate blank is a sample of laboratory demonstrated analyte-free water passed through and over the cleaned sampling equipment. A rinsate blank is used to indicate potential contamination from sample instruments used to collect and transfer samples. One rinsate blanks will be collected per twenty samples collected, or one rinsate blank will be collected for each day sediment sampling is conducted, whichever is greater.

Split Samples - Split samples (or QA samples) are used for performance audits or interlaboratory comparability of data. A split sample is defined as two separate samples taken from a single aliquot which has been thoroughly mixed or homogenized prior to the formation of the two separate samples. One split sample will be taken at a five percent frequency of all field samples and sent to a QA laboratory. The QA laboratory for this project is identified below. The QA laboratory will be notified approximately two weeks prior to any QA samples being shipped.

The QA laboratory shipping address is:

US Army Corps of Engineers
CQAB Lab
420 S. 18th Street
Omaha, NE 68102-2586
Attn: Laura Percifield
Phone - (402) 444-4300

QA samples will be assigned in the field. A Laboratory Information Management System (LIMS) # will be applied to the labels, chain-of-custody records, and all correspondence for all QA samples shipped to the QA lab throughout the project. The LIMS # is 5012.

9.0 CALCULATION OF DATA QUALITY INDICATORS

As discussed in Section 3.2, in order to ensure high quality and defensible data, data quality indicators will be measured during offsite chemical analysis. Calculation of these data quality indicators is presented below.

9.1 PRECISION

According to EM 200-1-3 (USACE 2001):

Precision refers to the distribution of a set of reported values about the mean, or the closeness of agreement between individual test results obtained under prescribed conditions. Precision reflects the random error and may be affected by systematic error. Precision also characterizes the natural variation of the matrix and how the contamination exists or varies within that matrix. Precision is evaluated using analyses of an analytical sample and its corresponding matrix duplicate and/or laboratory matrix spike/matrix spike duplicate, which not only exhibit sampling precision, but indicate analytical precision through the reproducibility of the analytical results. Precision determined by RPD shall be calculated as follows:

$$RPD = \frac{(X_1 - X_2)}{\left[\left(\frac{X_1 - X_2}{2}\right)\right]} x100$$

where:

X_1 = *Measured value of sample or matrix spike*

X_2 = *Measured value of duplicate or matrix spike duplicate*

9.2 ACCURACY

Analytical accuracy may be assessed through the use of known and unknown QC samples and spiked samples. Accuracy is presented as percent recovery. Accuracy will be determined from matrix spike, matrix spike duplicate, and laboratory control samples, as well as from surrogate compounds added to organic fractions and is calculated as follows:

$$Accuracy(\%R) = \frac{(X_s - X_u)}{K} x100$$

where:

Xs - Measured value of the spike sample

Xu - Measured value of the unspiked sample

K - Known amount of spike in the sample

9.3 COMPLETENESS

Completeness is calculated on a per matrix basis for the project and is calculated as follows:

$$Completeness(\%C) = \frac{(X_v - X_n)}{N} x100$$

where:

Xv - Number of valid measurements

Xn - Number of invalid measurements

N - Number of valid measurements expected to be obtained

9.4 METHOD DETECTION LIMITS (MDLS)

MDLs shall be determined for each target analyte using procedures outlined in 40 CFR Part 136, Appendix B. The method detection limit normally is calculated using data generated from reagent water. MDLs are calculated as follows:

$$MDL = t_{(n-1,\ 1-\mu\ =\ 0.99)}\ (S)$$

where: $t_{(n-1,\ 1-\mu\ =\ 0.99)}$ = Student's t-value appropriate to a 99% confidence level and a standard deviation estimate with n-1 degrees of freedom

S = Standard deviation of the replicate analyses

10.0 CORRECTIVE ACTIONS

Laboratory corrective actions shall be implemented to resolve problems and restore proper functioning to the analytical system when errors, deficiencies, or out-of-control situations exist at the laboratory. Full documentation of the corrective action procedure needed to resolve the problem shall be filed in the project records, and the information summarized in the case narrative. A discussion of the corrective actions to be taken is presented in the following sections.

10.1 INCOMING SAMPLES

Problems noted during sample receipt shall be documented on a Cooler Receipt Form. The USACE/URS Managers shall be contacted immediately for problem resolution. All corrective actions shall be documented thoroughly.

10.2 SAMPLE HOLDING TIMES

If any sample extraction and/or analyses exceed method holding time requirements, USACE/URS Managers shall be notified immediately for problem resolution. All corrective actions shall be documented thoroughly.

10.3 INSTRUMENT CALIBRATION

Sample analysis shall not be allowed until all initial calibrations meet the appropriate requirements. All laboratory instrumentation must be calibrated in accordance with USACE Shell requirements (USACE, 2001). If any initial/continuing calibration standards exceed method QC limits, recalibration must be performed, and if necessary, reanalysis of all samples affected back to the previous acceptable calibration check.

10.4 REPORTING LIMITS

The laboratory must meet all project-required detection limits. If difficulties arise in achieving these limits due to a particular sample matrix, the laboratory must notify USACE/URS project personnel for problem resolution. In order to achieve those detection limits, the laboratory must utilize all appropriate cleanup procedures (e.g., sulfur and acid cleanup for Method 8082) in an attempt to retain the project required detection limits. When any sample requires a secondary dilution due to high levels of target analytes, the laboratory must document all initial analyses and secondary dilution results. Secondary dilution will be permitted only to bring target analytes within the linear range of calibration. If samples are analyzed at a secondary dilution with no target analytes detected, USACE/URS Managers will be immediately notified so that appropriate corrective actions can be initiated, if necessary.

The laboratory will report all detections below the MRL but above the MDL and flag these semiquantitative data points as estimated.

10.5 METHOD QC

All QC, including blanks, matrix duplicates, matrix spikes, matrix spike duplicates, surrogate recoveries, laboratory control samples, and other method-specified QC samples, shall meet the requirements referenced in Table 6-1. Failure of QC will result in the review and possible qualification of all affected data. If the laboratory cannot find any errors, the affected sample(s) shall be reanalyzed and/or re-extracted/redigested, then reanalyzed within method-required holding times to verify the presence or absence of matrix effects. If matrix effect is confirmed, the corresponding data shall be flagged accordingly using the flagging symbols and criteria as defined by the data validation guidelines identified in Section 11.3. If matrix effect is not confirmed, then the entire batch of samples may have to be reanalyzed and/or re-extracted/redigested, then reanalyzed at no cost to the Government. The USACE shall be notified as soon as possible to discuss possible corrective actions should unusually difficult sample matrices be encountered.

10.6 CALCULATION ERRORS

All analytical results must be reviewed systematically for accuracy prior to submittal. If upon data review, calculation and/or reporting errors exist, the laboratory will be required to reissue the analytical data report with the corrective actions appropriately documented in the case narrative.

11.0 DATA REDUCTION, REVIEW, VALIDATION, AND REPORTING

The analytical data generated by the laboratory shall be reviewed to assure the usability of the reported results. This internal data review process will consist of data generation, reduction, a minimum of three levels of documented review, and reporting.

11.1 DATA REDUCTION

Laboratory analytical data are first generated in raw form at the instrument. These data may be in either graphic or tabular form. Specific data reduction, generation procedures, and calculations are found in each of the methods referenced in Table 6-1, as well as within the laboratory LQAPP. Analytical results must be reported consistently. Data reduction will be performed by individuals experienced with a particular analysis, and knowledgeable of project QA/QC requirements.

11.2 DATA REVIEW

The technician/analyst who generates the analytical data is responsible for its correctness and completeness. The data review process involves evaluating both the results of the QC data and the professional judgement of the person(s) conducting the review. Applying technical knowledge and experience to the evaluation of data is essential in verifying that high quality data are generated.

The laboratory has documented procedures, which are to be followed and must be accessible to all laboratory personnel. The data review is generally conducted in a three-step process at the laboratory prior to submittal:

Level 1 - Technical Data Review - The analysts review the quality of their work based on an established set of guidelines. The review will verify, at a minimum, that appropriate preparation, analysis, and standards operating procedures have been followed; analytical results are correct and complete; QC samples are within established control limits; and that documentation is complete (e.g., any anomalies have been documented).

Level 2 - Technical Review - This level of review will be performed by a supervisor or data review specialist whose function is to provide an independent review of the data package. This review shall also be conducted according to an established set of guidelines (i.e., method requirements and laboratory standard operating procedures). The Level 2 review includes a review of qualitative and quantitative data, and a review of documented anomalies.

Level 3 - Administrative Data Review - The final review of the data, prior to submittal, is performed by the QA/QC officer or program administrator at the laboratory. This level provides a total overview of the data package to verify its consistency and compliance with project requirements.

11.3 DATA VALIDATION

Data validation is a systematic procedure of reviewing a body of data against a set of established criteria to provide a specified level of assurance of validity prior to its intended use. The validation will be performed following the general guidelines in USEPA Contract Laboratory Program (CLP) National Functional Guidelines for Organic Data Review, EPA540/R-99/008, October 1999, USEPA CLP National Functional Guidelines for Inorganic Data Review, EPA540/R-01/008, July 2002. All samples will be reviewed independently (i.e., separately from the laboratory) for evaluation of data completeness, verification of chain-of-custody forms for correctness, review of holding time criteria, instrument calibration, assessment of QC blanks for contamination, assessment of laboratory precision and accuracy based upon duplicates and spike results and assessment of matrix interference. The independent review of data will be performed by environmental chemists, under the supervision of the URS Analytical Chemistry Task Manager, to verify compliance with specified analytical methods and project-specific precision, accuracy, representativeness, comparability, and completeness (PARCC) parameters.

11.4 DATA REPORTING

The laboratory hardcopy analytical reports will be equivalent to the Contract Laboratory Program (CLP) Organic and Inorganic Statement of Works, OLM04.2 and ILM04.0, respectively (or most current versions). A "Cooler Receipt Form" will also be required with each cooler and included in the deliverable data package for the purposes of noting problems in sample packaging, chain-of-custody, and sample preservation.

The laboratory will submit GISKey Electronic Data Deliverables.

11.5 LABORATORY TURNAROUND TIME

The contract laboratory will be required to submit the analytical hardcopy and electronic data packages, in accordance with Section 11.4, 21 working days from validated time of sample receipt at the laboratory.

12.0 PREVENTATIVE MAINTENANCE

The laboratory is responsible for the maintenance of its analytical equipment. Preventive maintenance is provided on a regular basis to minimize down-time and the potential interruption of analytical work. Instruments are maintained in accordance with the manufacturer's recommendations. If instruments require maintenance, only trained laboratory personnel or manufacturer-authorized service specialists are permitted to do the work. Maintenance activities will be documented and kept in permanent logs. These logs will be available for inspection by auditing personnel.

13.0 PERFORMANCE AND SYSTEM AUDITS

Audits are systematic examinations to determine whether activities comply with planned arrangements, whether the arrangements are implemented effectively, and whether the results are suitable to achieve project objectives.

No field or laboratory audits are anticipated for this project. The contract laboratory regularly undergoes performance evaluation audits by the USACE and has current validations for the analytical methods to be used for this project.

13.1 PERFORMANCE AND EXTERNAL AUDITS

In addition to conducting internal reviews and audits, as part of its established quality assurance program, the laboratory is required to take part in regularly-scheduled performance evaluations and laboratory audits from state and federal agencies. They are conducted as part of the certification process and to monitor the laboratory performance. The audits also provide an external quality assurance check of the laboratory and provide reviews and information on the management systems, personnel, standard operating procedures, and analytical measurement systems. Acceptable performance on evaluation samples and audits is required for certification and accreditation. The laboratory shall use the information provided from these audits to monitor and assess the quality of its performance. Problems detected in these audits shall be reviewed by the QA Scientist and Laboratory Manager, and corrective action shall be instituted as necessary.

13.2 SYSTEMS/INTERNAL AUDITS

As part of its Quality Assurance Program, the Laboratory Quality Assurance Scientist shall conduct periodic checks and audits of the analytical systems. The purpose of these is to verify that the analytical systems are working properly, and that personnel are adhering to established procedures and documenting the required information. These checks and audits also assist in determining or detecting where problems are occurring.

The QA Scientist periodically will submit laboratory control samples. These samples will serve to check the entire analytical method, the efficiency of the preparation method, and the analytical instrument performance. The results of the control samples are reviewed by the QA Scientist who reports the results to the analyst and the Laboratory Director. When a problem is indicated, the QA Scientist will assist the analyst and laboratory management in determining the reason and in developing solutions. The QA Scientist also will recheck the systems as required.

14.0 QC REPORTS TO MANAGEMENT

After the fieldwork and the final analyses have been completed and reviewed, the Analytical Task Manager will submit a Data Review Report evaluating the PARCC parameters. The Data Quality Control report will be submitted as an appendix to the Post-Removal Sediment Sampling Report.

15.0 REFERENCES

American Society for Testing and Materials (ASTM), 2001. Annual Book of ASTM Standards. American Society for Testing and Materials.

Krone, 1988. *Method for Analysis of Butyltin Species and Measurment of Butyltins in Sediment and English Sole Livers.*

Oregon Department of Environmental Quality. 2001. Guidance for Ecological Risk Assessment, Level II Screening Level Values.

Puget Sound Water Quality Authority (PSWQA), 1996. Recommended guidelines for measuring organic compounds in Puget Sound water, sediment, and tissue samples. Environmental laboratory for the Puget Sound Water Quality Authority, Lacey, Washington.

USACE. 2001. *Environmental Quality, Requirements for the Preparation of Sampling and Analysis Plans, Regulation No. EM 200-1-3.* 1 February. Washington: USACE.

USEPA. 2002. CLP National Functional Guidelines for Inorganic Data Review, EPA540/R-01/008, July.

USEPA. 1999. CLP National Functional Guidelines for Organic Data Review, EPA540/R-99/008, October.

USEPA. 1997. *Test Methods For Evaluating Solid Waste, Physical/Chemical Methods, SW-846 Integrated Manual*, Final Update III. June. Washington, DC: OSWER.

USEPA. 1993. *Data Quality Objectives Process for Superfund*, Interim Final Guidance, EPA540-R-93-071. September. Washington: USEPA.

USEPA. 1991. *Draft - Analytical Method for Determination of Acid Volatile Sulfide and Selected Simultaneously Extractable Metals in Sediment.* Office of Water. EPA821/R-91-100. December 1991.

Washington State Department of Ecology. 1997. Analytical Methods for Petroleum Hydrocarbons. ECY 97-602.

TABLES

TABLE 3-1
QA Objectives Summary

Data Use	Matrix	Analytical Method	No. of Field Samples	No. of Field Duplicate Samples	No. of Equipment Rinsate Samples	No. of QA (Split) Samples	Data Category	Precision (RPD)		Lab Accuracy (Matrix Spikes)	Completeness
								Field Dups	Lab Dups		
Characterize nature and extent of sediment contamination and determination of background/ambient concentrations	Sediment	EPA 8270C for SVOCs	105	10	1 per day or 6 (whichever is greater)	5	Definitive	≤ 50 RPD	Not Applicable	45-135% Recovery	100%
	Sediment	EPA 8082 for PCB Aroclors	109	10	1 per day or 6 (whichever is greater)	5	Definitive	≤ 50 RPD	Not Applicable	40-140% Recovery	100%
	Sediment	EPA 8081A for Organochlorinated Pesticides	105	10	1 per day or 6 (whichever is greater)	5	Definitive	≤ 50 RPD	Not Applicable	40-140% Recovery	100%
	Sediment	NWTPH-Dx for Diesel Range Organics	105	10	1 per day or 6 (whichever is greater)	5	Definitive	≤ 50 RPD	Not Applicable	50-150% Recovery	100%
	Sediment	Krone GC-MS For Butyltins	105	10	1 per day or 6 (whichever is greater)	5	Definitive	≤ 50 RPD	Not Applicable	30-125% Recovery	100%
	Sediment	EPA 6020 for TAL Metals	105	10	1 per day or 6 (whichever is greater)	5	Definitive	≤ 50 RPD	Not Applicable	75-125% Recovery	100%
	Sediment	EPA 7471A for Mercury	105	10	1 per day or 6 (whichever is greater)	5	Definitive	≤ 50 RPD	Not Applicable	80-120% Recovery	100%
Determine contaminant fate and bioavailability	Sediment	EPA 9060 for TOC	109	10	1 per day or 6 (whichever is greater)	5	Definitive	≤ 50 RPD	≤ 25 RPD	85-115% Recovery	100%
	Sediment	ASTM D422 for Grain Size	109	10	NA	5	Definitive	≤ 50 RPD	Not Applicable	Not Applicable	100%
	Sediment	EPA 9045C for pH	10	1	NA	1	Definitive	≤ 50 RPD	≤ 10 RPD	Not Applicable	100%
	Sediment	ASTM D2216-90 for Moisture Content	10	1	NA	1	Definitive	≤ 50 RPD	≤ 10 RPD	Not Applicable	100%
	Sediment	EPA Draft 821/R-91-100 for AVS/SEM	10	1	NA	1	Definitive	≤ 50 RPD	Not Applicable	75-125% Recovery	100%

TABLE 3-1
QA Objectives Summary

Data Use	Matrix	Analytical Method	No. of Field Samples	No. of Field Duplicate Samples	No. of Equipment Rinsate Samples	No. of QA (Split) Samples	Data Category	Precision (RPD)		Lab Accuracy (Matrix Spikes)	Completeness
								Field Dups	Lab Dups		
Determine contaminant fate and bioavailability	Water	EPA 160.2 for TSS	10	1	NA	1	Definitive	≤ 20 RPD	≤ 10 RPD	Not Applicable	100%
	Water	EPA 415.1 for DOC	10	1	NA	1	Definitive	≤ 20 RPD	≤ 10 RPD	Not Applicable	100%
	Water	EPA 130.2 for Hardness	10	1	NA	1	Definitive	≤ 20 RPD	≤ 10 RPD	Not Applicable	100%
	Water	EPA 150.1 for pH	10	1	NA	1	Definitive	≤ 20 RPD	≤ 10 RPD	Not Applicable	100%

Notes:

AVS/SEM – Acid Volatile Sulfides/Simultaneously Extracted Metals
DOC – Dissolved Organic Carbon
EPA – Environmental Protectin Agency
GC-MS – Gas Chromatography-Mass Spectrometry
No. – Number
NWTPH – Northwest Total Petroleum Hydrocarbons
PCB – Polychlorinated Biphenyls
PSEP – Puget Sound Estuary Program
QA – Quality Assurance (Field Duplicate submitted to the USACE QA Laboratory)
RPD - Relative Percent Difference
SVOCs- Semivolatile Organic Compounds
TAL – Target Analyte List
TOC – Total Organic Carbon
TSS- Total Suspended Solids

TABLE 5-1
Sample Methods and Container, Preservation, and Holding Time Requirements for Sediment Samples*

ANALYTICAL PARAMETER	METHOD	CONTAINER	PRESERVATION	HOLDING TIMES**
Semivolatile Organic Compounds (SVOCs)	SW8270C	1-8 oz CWMglass	4 °C	14 days to extract, then 40 days to analyze
Polychlorinated Biphenyls (PCBs) - Aroclors	SW8082	1-8 oz CWMglass	4 °C	14 days to extract, then 40 days to analyze
Organochlorinated Pesticides	SW8081A	1-8 oz CWMglass	4 °C	14 days to extract, then 40 days to analyze
Northwest Total Petroleum Hydrocarbons – Diesel Range Organics (NWTPH-Dx)	NWTPH-Dx	1-8 oz CWMglass	4 °C	14 days to extract, then 40 days to analyze
Butyltins	Krone GC/MS	1-8 oz CWMglass	4 °C	14 days to extract, then 40 days to analyze
Metals (except mercury)	SW6020	1-8 oz CWM glass	4 °C	180 days to analyze
Mercury	SW7471A	1-8 oz CWM glass	4 °C	28 days to analyze
Total Organic Carbon (TOC)	SW9060	1-8 oz CWM glass	4 °C	28 days to analyze
Grain Size (Sieve and Hydrometer)	ASTM D422	32 oz CWM	None	None
pH	9045C	1-4 oz CWM glass	4 °C	Upon receipt
Moisture Content	ASTM D2216-90	1-4 oz CWM glass	4 °C	None
Acid Volatile Sulfide (AVS) and Simultaneously Extractable Metals (SEM)	EPA Draft 821/R-91-100***	1-8 oz CWM glass	4 °C	14 days to analyze

Notes:

* An extra 8-oz CWM glass jar will be collected at each sample location to be frozen and archived at the laboratory.
*Triple volume must be collected for MS/MSD samples.
**Holding times are from date of sample collection.
***EPA Draft document entitled Analytical Method for Determination of Acid Volatile Sulfide and Selected Simultaneously Extractable Metals in Sediment. (December 1991).
All containers will have Teflon-lined seals or septa (i.e.; NWTPH-Gx)
CWM – Clear wide mouth glass jar

TABLE 5-2
Sample Methods and Container, Preservation, and Holding Time Requirements for Water Samples*

ANALYTICAL PARAMETER	METHOD	CONTAINER	PRESERVATION	HOLDING TIMES**
Total Suspended Solids (TSS)	EPA 160.2	1-250 ml HDPE	4 °C	7 days
Dissolved Organic Carbon (DOC)***	EPA 415.1	1-250 ml AGJ	4 °C , H_2SO_4 to pH<2	28 days
Hardness	EPA 130.2	1- 125 ml HDPE	4 °C , H_2SO_4 to pH<2	6 months
pH	EPA 150.1	1- 125 ml HDPE	4 °C	Upon receipt

Notes:

*Triple volume must be collected for MS/MSD samples.
**Holding times are from date of sample collection.
***DOC sample must be field filtered before filling the sample container.
AGJ – Amber Glass Jar
HDPE- High Density Polyethylene Bottles

TABLE 6-1
Analytical Methods

Parameter	Preparation Method Number	Cleanup Method Number*	Analysis Method Number	Reference
Sediment				
Semivolatile Organic Compounds (SVOCs)	3550B	3640A if necessary	8270C	1
Polychlorinated Biphenyls (PCB) - Aroclors	3550B	3660B	8082	1
Organochlorinated Pesticides	3550B	3620B	8081A	1
Northwest Total Petroleum Hydrocarbons – Diesel Range Organics (NWTPH-Dx)	3550B	3620B or 3630C if necessary	NWTPH-Dx	1/3
Butyltins	Krone	Krone	Krone	6
Metals	3050B	None	6020	1
Mercury	Not Applicable	None	7471A	1
Total Organic Carbon (TOC)	Not Applicable	None	9060	1
Grain Size (Sieve and Hydrometer)	Not Applicable	Anticoagulation (optional)	D422	4
pH	Not Applicable	None	9045C	1
Moisture Content	Not Applicable	None	D2216-90	4
Acid Volatile Sulfide (AVS) and Simultaneously Extractable Metals (SEM)	Not Applicable	None	EPA Draft 821/R-91-100	5
Water				
Total Suspended Solids (TSS)	Not Applicable	None	160.2	2
Dissolved Organic Carbon (DOC)	Not Applicable	None	415.1	1
Hardness	Not Applicable	None	130.2	2
pH	Not Applicable	None	150.1	2

*Additional cleanup options are available as discussed in Section 6.0 and will be applied as necessary.

References:

1. USEPA, *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846, Integrated Manual, Final Update III*, June 1997.
2. USEPA, *Methods for Chemical Analysis of Water and Wastes, EPA-600*, Revised March 1983.
3. Washington State Department of Ecology, 1997. Analytical Methods for Petroleum Hydrocarbons. ECY 97-602.
4. American Society for Testing and Materials (ASTM), 2001. Annual Book of ASTM Standards.
5. USEPA, 1991. *Draft Analytical Method for Determination of Acid Volatile Sulfide and Selected Simultaneously Extractable Metals in Sediment.* December 1991.
6. Krone, 1988. *Method for Analysis of Butyltin Species and Measurement of Butyltins in Sediment and English Sole Livers.*

TABLE 6-2
Sediment Reporting Limits

Analyte	Sediment Reporting Limits* (µg/kg)	DEQ Level II Screening Level Values for Freshwater Sediment ** (µg/kg)
SVOCs-8270C		
1,2,4-Trichlorobenzene	20	No value
1,2-Dichlorobenzene	20	No value
1,3-Dichlorobenzene	20	No value
1,4-Dichlorobenzene	20	No value
2,4,5-Trichlorophenol	100	No value
2,4,6-Trichlorophenol	100	No value
2,4-Dichlorophenol	60	No value
2,4-Dimethylphenol	20	No value
2,4-Dinitrophenol	200	No value
2,4-Dinitrotoluene	100	No value
2,6-Dinitrotoluene	100	No value
2-Chloronaphthalene	20	No value
2-Chlorophenol	20	No value
2-Methylnaphthalene	20	No value
2-Methylphenol	20	No value
2-Nitroaniline	100	No value
2-Nitrophenol	100	No value
4-Methylphenol	20	No value
3,3´-Dichlorobenzidine	100	No value
3-Nitroaniline	120	No value
4,6-Dinitro-2-methylphenol	200	No value
4-Bromophenyl phenyl ether	20	No value
4-Chloro-3-methylphenol	40	No value
4-Chloroaniline	60	No value
4-Chlorophenyl phenyl ether	20	No value
4-Nitroaniline	100	No value
4-Nitrophenol	100	No value
Acenaphthene	20	290
Acenaphthylene	20	160
Aniline	20	No value
Anthracene	20	57
Benzo (a) anthracene	20	32
Benzo (a) pyrene	20	32
Benzo (b) fluoranthene	20	No value
Benzo (ghi) perylene	20	300
Benzo (k) fluoranthene	20	27
Benzoic Acid	200	No value
Benzyl alcohol	20	No value
Bis(2-chloroethoxy)methane	20	No value
Bis(2-chloroethyl)ether	40	No value
Bis(2-ethylhexyl)phthalate	20	750
Butyl benzyl phthalate	20	No value
Carbazole	20	140

TABLE 6-2
Sediment Reporting Limits

Analyte	Sediment Reporting Limits* (µg/kg)	DEQ Level II Screening Level Values for Freshwater Sediment ** (µg/kg)
Chrysene	20	57
Di-n-butyl phthalate	20	110
Di-n-octyl phthalate	20	No value
Dibenz (a,h) anthracene	20	33
Dibenzofuran	20	5100
Diethyl phthalate	20	No value
Dimethyl phthalate	20	No value
Fluoranthene	20	111
Fluorene	20	77
Hexachlorobenzene	20	100
Hexachlorobutadiene	20	No value
Hexachlorocyclopentadiene	100	No value
Hexachloroethane	20	No value
Indeno (1,2,3-cd) pyrene	20	17
Isophorone	20	No value
N-Nitrosodimethylamine	20	No value
N-Nitrosodi-n-propylamine	40	No value
N-Nitrosodiphenylamine	100	No value
Naphthalene	20	176
Nitrobenzene	20	No value
Pentachlorophenol	100	No value
Phenanthrene	20	42
Phenol	20	48
Pyrene	20	53
PCBs - Aroclors		
Aroclor 1016	20	No value
Aroclor 1242	20	No value
Aroclor 1248	20	21
Aroclor 1254	20	7
Aroclor 1260	20	No value
Organochlorinated Pesticides		
Alpha-BHC	1	No value
Beta-BHC	1	No value
Gamma-BHC (Lindane)	1	0.9
Delta-BHC	1	No value
Heptachlor	1	10
Aldrin	1	40
Heptachlor Epoxide	1	0.6
Gamma chlordane	1	4.5
Alpha chlordane	1	No value
Endosulfan I	1	No value
DDE	2	1.5
Dieldrin	2	3
Endrin	2	3
Endosulfan II	2	No value
DDD	2	4

TABLE 6-2
Sediment Reporting Limits

Analyte	Sediment Reporting Limits* (µg/kg)	DEQ Level II Screening Level Values for Freshwater Sediment ** (µg/kg)
Endrin Aldehyde	2	No value
DDT	2	4
Endosulfan Sulfate	2	No value
Endrin Ketone	2	No value
Methoxychlor	10	No value
Hexchlorobutadiene	1	No value
Hexachlorobenzene	1	100
Toxaphene	100	No value
Diesel Range Hydrocarbons	5000	No Value
Heavy Oil Range Hydrocarbons	5000	No Value
Butyltins		
Monobutyltin	12	No Value
Dibutyltin	12	No Value
Tributyltin	6	No Value
Metals		
Arsenic	500	6000
Chromium	500	37000
Cobalt	200	No value
Copper	500	36000
Iron	20000	No value
Lead	1000	35000
Mercury	50	200
Nickel	500	18000
Selenium	500	No Value
Zinc	400	123000
TOC	200,000	No Value
Grain Size (Sieve and Hydrometer)	0.0014 mm	No Value

Notes:

* Reporting limits listed are highly matrix-dependent and may not always be achievable. Reporting limits for sediments are based on wet weight. The reporting limits, calculated on a dry-weight basis, will be higher. In order to compare typical laboratory reporting limits with screening values, reporting limits from Analytical Resources Incorporated laboratory were used. The laboratory contracted to conduct the analysis will obtain similar reporting limits.

**Oregon Department of Environmental Quality. 2001. Guidance for Ecological Risk Assessment, Level II Screening Level Values.

Highlighted cells indicate method reporting limits above the DEQ Level II Freshwater Sediment Screening Level Value. In all cases, the method detection limit for these compounds is below the screening level value.

TABLE 6-3
Water Reporting Limits

Analyte	Water Reporting Limits* (mg/L)	DEQ Level II Screening Level Values for Surface Water (µg/kg)
Total Suspended Solids	1.0	No value
Dissolved Organic Carbon	1.5	No value
Hardness	1.0	No value

* Reporting limits listed are from Analytical Resources Incorporated laboratory. The laboratory contracted to conduct the analysis will obtain similar reporting limits.

Laboratory USACE Certification will provided following selection of the laboratory.